

THE GENESIS OF SPECIES*

IT is a remarkable illustration of the apparently fitful manner in which our knowledge of Nature increases, that the event which has probably been more fruitful than any other during the present century in inducing practical advances in the study of Natural History, was the promulgation of a pure theory, the publication, namely, by Mr. Darwin and Mr. Wallace, of the doctrine of the Origin of Species by means of Natural Selection. We say a pure theory, because the genesis of a new species is a phenomenon which never has yet, and probably never will, come conspicuously under the cognizance of man. We see forms of animal and vegetable life die out before our eyes, but their birth is not within our ken. As Mr. Darwin has pointed out, even should a new species suddenly arise, we

have no means of recognising it as such. As a matter of fact, new plants and animals are constantly being discovered in all parts of the globe. Even in our own small and well-searched island, the additions within the last twenty years of more or less conspicuous flowering plants to our native flora are not inconsiderable; but no naturalist suggests any other interpretation of this, than that either they have been overlooked before, have been recently introduced from other countries, or that the seeds have been buried for ages in the soil. None the less, however, does it seem possible, or even probable, that we may eventually arrive at a correct solution of the problem by a rigorous induction from known facts.

So recently as the date of the publication of the first edition of the "Origin of Species," in 1859, Mr. Darwin wrote, "The great majority of naturalists believe that species are



FIG. 1.—Leaf Butterfly in Flight and Repose.
The lowest apparent leaf on the stem is in reality the under side of the wing of the same butterfly which is represented in the upper part of the picture.

immutable productions, and have been separately created;" and the statement has been repeated in subsequent editions. We think, however, that it is impossible, at the present time, to sustain the correctness of this assertion. A writer in the "Botanische Zeitung"† has recently shown that there is some reason to believe that Linnæus himself, in later years, considerably modified the rigidity of his adherence to the doctrine which he laid down so decisively in his earlier writings:—"Species tot numeramus quot diversæ formæ in principio sunt creatæ."‡ During the eighteenth and the first half of the present century, however, it was only a few naturalists of more than ordinarily

keen powers of reasoning and prodigious knowledge of Nature—Lamarck, Buffon, Geoffroy St. Hilaire, Owen (in his earlier writings), and some others—who were bold enough to enunciate the theory that species have been created by a process of evolution from earlier closely-allied forms of life. Since the publication of the "Origin of Species," we may say that almost the whole body of the younger naturalists of this country and of Germany—Von Baer, Huxley, Spencer, and Haeckel leading the way after Darwin and Wallace—have given in their adhesion to the doctrine of Evolution. It is only within the last twelvemonth that the evolutionists can claim so great an accession to their strength as that distinguished systematist, the President of the Linnean Society.*

* "On the Genesis of Species." By St. George Mivart, F.R.S. (London: Macmillan and Co., 1871.)

† Botanische Zeitung, Sept. 9, 1870.

‡ Linn. Phil. Bot. Aphor. 157, p. 99.

* Bentham, "On the Species of Cassia," a paper read before the Linnean Society in 1870, but not yet published.

Along with this theory, these two writers introduced another, of the *modus operandi* by which this evolution is mainly or entirely effected, that of a process of Natural Selection from spontaneous variations. This doctrine was supported by an enormous array of facts, and by a brilliancy of argument which caused it at first to be as eagerly and generally adopted as the other. During

the last few years, however, it may be said that a reaction has been setting in in an opposite direction, and attention has been widely called to difficulties in the way of the full adoption of the theory of Natural Selection, at first overlooked, the force of some of which has been admitted, with his usual candour, by Mr. Darwin himself. Some of these objections were pointed out by Mr. J. J. Murphy in

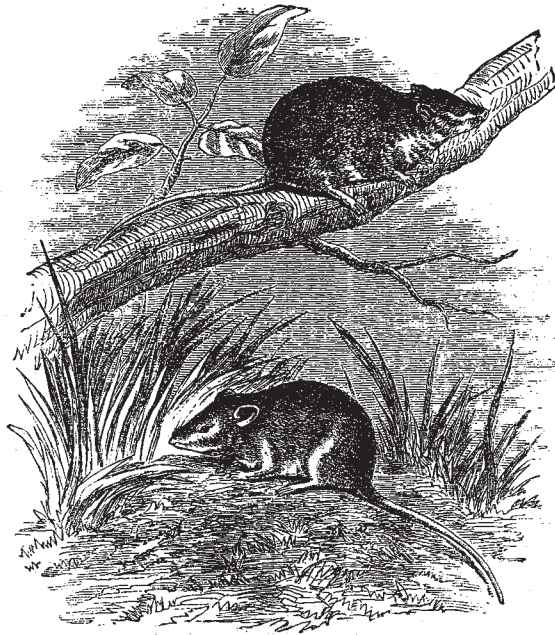


FIG. 2.—Upper Figure—*Artechinus minutissimus* (*implacental*).
Lower Figure—*Mus delicatulus* (*placental*).

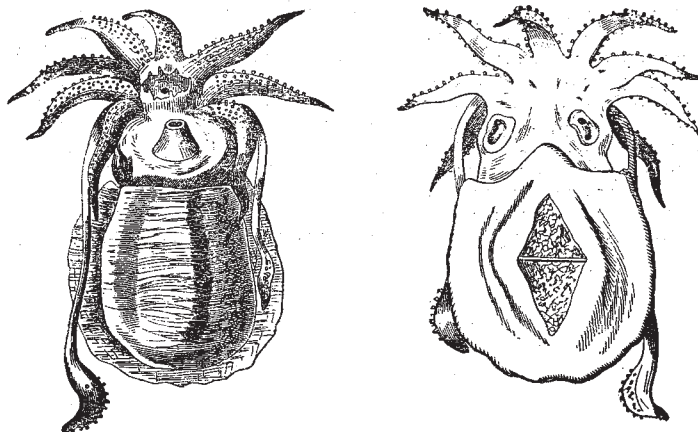


FIG. 3.—Cuttle-fish. Ventral and Dorsal Aspect.

his elaborate essays, entitled "Habit and Intelligence," published in 1869; on others Mr. Mivart dwells in the volume now before us, the most recent contribution to this department of literature.

A theory may be true, and yet may not be adequate. To take an illustration from the realm of mind. The believer in the doctrine of innate ideas will admit that the greater number of our conceptions

are the result of habit, imitation, and training; he believes, however, that there are others which cannot thus be adequately accounted for, and which are innate and independent of subsequent education. In the same manner Mr. Mivart and those who think with him freely admit the potency of Natural Selection to have produced the greater number of the specific forms and organic structures we see around us; for the production of others

they believe that it can be proved to be inadequate, and that we must look to some other innate principle for their formation. Mr. Mivart supports his arguments with so much cogency of reasoning, so great a knowledge of anatomical structure, and so complete an acknowledgment of the strength of his opponents' position, that they cannot be disregarded by any one interested in the subject. His objections are the more deserving of careful consideration, inasmuch as he states that he was himself by no means disposed originally to dissent from the theory of Natural Selection, if only its difficulties could be solved, but that he has found each successive year that deeper consideration and more careful examination have more and more brought home to him the inadequacy of Mr. Darwin's theory to account for the preservation and intensification of incipient specific and generic characters. It behoves, therefore, every Darwinian to satisfy himself that either Mr. Mivart's premisses or his line of argument is unsound.

The objections brought forward by the author are summed up as follows:—(1.) That Natural Selection is incompetent to account for the incipient stages of useful structures. (2.) That it does not harmonise with the co-existence of closely similar structures of diverse origin. (3.) That there are grounds for thinking that specific differences may be developed suddenly instead of gradually. (4.) That the opinion that species have definite though different limits to their variability is still tenable. (5.) That certain fossil transitional forms are absent which might have been expected to be present. (6.) That some facts of geological distribution supplement other difficulties. (7.) That the objection drawn from the physiological difference between "species" and "races" still exists unrefuted. (8.) That there are many remarkable phenomena in organic forms upon which Natural Selection throws no light whatever, but the explanations of which, if they could be attained, might throw light upon specific origination. If these objections are not new, they are at least sustained by new arguments. They are evidently of very unequal value. The third is very difficult of proof or disproof. The fifth may be true in our present state of knowledge, but would be very unsafe by itself as the basis of an argument. The first, second, and eighth are of greatest value, and are those which Mr. Mivart has most closely worked out.

Hitherto the attention of those scientific naturalists who have concerned themselves with the intricate problems of organic life, has been directed almost exclusively to the animal kingdom. This may have arisen from the greater attractiveness and practical interest of the study of zoology, or from the fact that in the popular mind (and we fear the error is not confined to mere "popular" writers) natural history and zoology are considered convertible terms. Be this as it may, the number of botanists, with the illustrious exception of Mr. Darwin himself, who look on their science in a philosophic spirit, is lamentably small. We believe, however, that more light will be found to be thrown on the problem of the genesis of species by a consideration of the phenomena of the vegetable than of the animal kingdom. Plants have less power of adapting themselves to new conditions, or of finding for themselves more congenial surroundings, than have animals. Their locality and their food are, as it were, prescribed for them by the circumstances of their birth; here, therefore, we might expect to find the rule of the survival of the fittest to reign supreme. We believe, however, it would be very difficult to substantiate any instances of species of plants being supplanted by other closely allied species, similar to those well-authenticated in the case of the rat and the cockroach. Plants when first artificially introduced into a new country undoubtedly frequently spread with extraordinary rapidity, to the destruction of weeds belonging to native races; but this is evidently not the mode in which species have supplanted one another in a state of pure nature.

Under Mr. Mivart's first head, he deals with the subject

of Mimicry, contending that Natural Selection is incompetent to account either for the first or last stages of such wonderful instances of protective resemblance as that represented in our illustration. As this subject has been so recently discussed in these columns, we need not dwell upon it further than to remark, that we think the author could have supported his case with arguments of even greater force, had he extended his observations to the vegetable kingdom. The only object which it has been conjectured can be gained by a plant imitating a different species or a foreign structure, is to attract insects to assist in the distribution of its pollen. The most remarkable instances of the imitation by plants of foreign objects is in the case of the curious resemblance of the flowers of certain orchids to insects and other animals. One of the most singular of these is the well-known bee-orchid. But, as Mr. Mivart remarks, Mr. Darwin, in a course of observations extending over a series of years, has never seen a bee alight on this orchid. The most noteworthy resemblance again of plants *inter se* unconnected with organic affinity, are not in the flowers, where they might be useful, but in the leaves, or in the whole stem and foliage. It is difficult to conjecture any advantage that is gained by the close resemblance between an African Euphorbia and a South American Cactus, the imitation being carried out in the most extraordinary manner throughout the vegetative organs, the flowers being, of course, totally unlike.

But besides these superficial resemblances, there are also analogies of organic structure in different classes of the animal kingdom, which Mr. Mivart holds to be equally opposed to the theory of Natural Selection. He refers especially to the existence of the higher organs of sense, as the eye, in at least three distinct and independent lines of descent, the Mollusca, the Annulosa, and the Vertebrata, an objection already pointed out by Mr. Murphy; to the resemblance between the shells of certain Mollusca and Crustacea, the valve being moved in each case by analogous muscles; to the analogy between the different families of Marsupials and the different orders of Placental Mammals; and to numerous other instances. These might be supplemented in the vegetable kingdom by the similarity in the mode of opening of the anthers in Berberidaceæ and Lauraceæ, or the extraordinary resemblance of certain Conifers to flowerless plants. The wood-cuts which we give illustrate the remarkable resemblance between an ordinary European mouse and an Australian marsupial (Fig. 2); the structure of the cuttle-fish with the brain, cartilaginous cranium, and complex auditory nerve, presenting so many similarities to those of the higher Vertebrata, and yet belonging to a different line of descent (Fig. 3); and the curious bird's-head-like processes found in some of the higher Polyzoa (Fig. 4).

Of exceptional structures, none is more interesting in a philosophical point of view than the neck of the giraffe. This has been explained on Darwinian principles from the occurrence in its native country of occasional periods of drought, during which those giraffes only have survived which had the power of reaching somewhat higher branches of the trees; and this peculiarity, being advantageous, was propagated, and continually augmented during each period of drought by the process of Natural Selection. To this Mr. Mivart objects, firstly, that if this explanation is correct, many other African animals, which have no greater power of endurance or of migration than the giraffe, ought to have elongated necks; and secondly, that in the intervals between the droughts the long neck would be a positive disadvantage, as requiring a greatly increased size and strength of muscles to support it, and would, consequently, be lost before the next drought set in. To take another instance of the commencement of an organic structure which is universal in all the higher classes of animals; there is scarcely anything more inexplicable than the separation of the sexes, if we suppose animals with distinct sexes to have originated by the pro-

cess of Natural Selection from those simple forms which propagate by cell-multiplication or spontaneous fission.

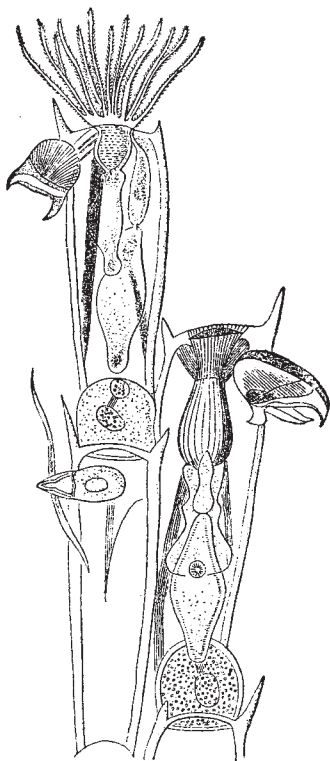


FIG. 4.—A Polyzoon with Bird's-head Processes.

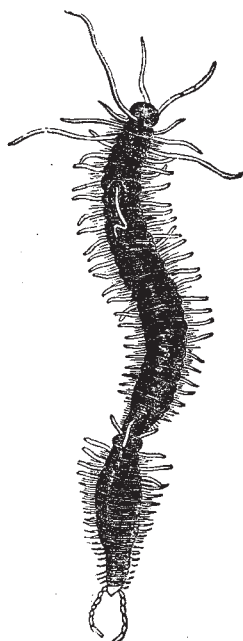


FIG. 5.—An Annelid dividing spontaneously. (A new head having been formed towards the hinder end of the body of the parent.)

We have not space to enumerate all our author's arguments, for which we must refer our readers to the volume

itself, wherein even those who differ from his conclusions will find a mine of physiological information and ingenious speculation. Nor can we do more than allude to the theological portion of the work, wherein he ably defends the doctrine of Evolution against both the *odium theologicum* and the *odium anti-theologicum*.

The present state of the argument we take to be this:—The theory of Natural Selection, in the hands of Mr. Darwin and Mr. Wallace, afforded a simple, a beautiful, and a valid solution of the origin of a large number of the organic phenomena by which we are surrounded; by many disciples of Mr. Darwin it has been assumed, perhaps too rashly, as adequate to account for the entire evolution of all the existing forms of animal and vegetable life from one or a few primordial germs. To this idea, so seductive in its very simplicity, a number of more or less cogent objections have now been urged. It is possible that on still closer examination, these objections will be found to break down; but in the meantime we must suspend our judgment; and in order to save defeat, the next move must be made by the advocates of Natural Selection, a *prima facie* case against them having at all events been made out. Mr. Mivart has no counter theory to propose, beyond a belief that there exists in all organic life an innate power analogous to intelligence, which controls their actions as reason does those of men. Should the inquiries which are now being energetically pursued on every side result in our acquiring more accurate knowledge of such a force, it will be safe to predict that to it will then be ascribed a more easy and natural solution of many phenomena which we are now forced to attribute to Natural Selection.

ALFRED W. BENNETT

NOTES

THE Royal Commission on Scientific Instruction and the Advancement of Science is about to resume its sittings, and meetings will be held at 6, Old Palace Yard, Westminster, on Thursday, February 9; Friday, February 10; Monday, February 13; Tuesday, February 14, at 11.30 A.M.

IN the recent changes which have taken place in the Royal Mint by the deaths of Professors Graham and Miller, Dr. Stenhouse, F.R.S., lost his position as Non-resident Assayer to the establishment. Several of our leading chemists, including Sir Benjamin Brodie, and Professors Williamson, Frankland, and Odling thought that this was an opportunity for recognising the services which Dr. Stenhouse had rendered to chemistry by his numerous researches, and they requested Dr. Lyon Playfair, M.P., to bring his claims before the Premier. We have now the gratification to announce that the representation has been successful, and that Her Majesty has directed that a pension on the Civil List of 100*l.* should be given to Dr. Stenhouse "in consideration of his scientific attainments."

THE shelling of Paris has been disastrous to M. Desnoyers, the librarian of the Museum, who lost his son by it. The celebrated Abbé Moigno, editor of *Les Mondes*, was slightly hurt by the breaking of a glass, from an explosive shell. The private apartment of M. Milne-Edwards was visited by a shell which has done much harm to the valuable furniture. Another shell penetrated into the Gallery of Zoology and caused much damage to the glass-work; and again another into the Gallery of Mineralogy, in the very place where M. Daubrée performs his experiments on artificial meteors; but happily it had exhausted its force, and did but little harm. Many instances of this description have occurred, where shells were sent to their utmost range, and did not explode under such circumstances. The reverse has however been observed, for one shell falling in the Seine with great force, the water offered resistance like a solid body, and explosion took place: the effect was curious. A shell fell in the